

NEW RECORDS OF FUNGI AND SLIME MOULDS AT KINGS PARK, PERTH, WESTERN AUSTRALIA

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ABSTRACT

Field surveys were conducted in 2009 and 2010 to assess the biodiversity of fungi and slime moulds at Kings Park, a major urban bushland and botanic garden located 1.5 km from central Perth in Western Australia. A total of 124 fungi and 14 slime moulds were identified to species level or assigned species phrase names from the surveys. Only 21% of them were recorded in both of the surveys. Seventy six percent of the fungi (94 of 124) and 86% of the slime moulds (12 of 14) from the 2009–2010 surveys are considered to be new records for Kings Park. Seven of the fungal species had not been recorded before in Western Australia. To date, 168 fungi and 26 slime moulds have been identified to species level from Kings Park. The total number of fungi and slime mould species known from Kings Park to date is undoubtedly much greater. Many unidentified or possibly inaccurately identified records of fungi and slime moulds from Kings Park remain to be verified.

INTRODUCTION

Kings Park and Botanic Garden is located 1.5 km from central Perth, Western Australia. It includes a regionally significant bushland covering about 267 ha of the 400 ha Park. Ongoing protection and improvement of knowledge about bushland flora, fauna and fungi has direct relevance to the strategic policies in the Kings Park and Botanic Garden Draft Management Plan 2009–2014 (Botanic Gardens and Parks Authority 2009). A recent historical review of fungi

records (including slime moulds) at Kings Park up to 2009 concluded that the knowledge base about the fungi to date is poor because efforts to document the fungi there have been mostly sporadic, uncoordinated and largely unverifiable (Bougher 2010a). Based on the historical records overall the review determined that Kings Park is likely to have many hundreds of species of fungi. However the number of species of fungi accurately recorded so far at Kings Park is uncertain. This is because

145 of the 285 scientific names recorded from Kings Park up to 2009 are not based on voucher specimens retained at a herbarium and therefore cannot be verified.

A total of 108 fungi and 14 slime mould species have been identified from Kings Park before 2009 – 80 of which are vouchered at the Western Australian Herbarium and 42 are unvouchered (Bougher 2010a). This is a relatively low number of species when compared to the known species richness of some other nearby bushlands, e.g. Bold Park where recent surveys undertaken over an eleven year period have recorded over 400 species of fungi (Bougher 2010b). In order to improve the knowledge base about fungi at Kings Park, field surveys commissioned by the Botanic Gardens and Parks Authority (BGPA) have been undertaken in 2009 and 2010 by the author in conjunction with volunteer community members and BGPA staff (Bougher 2009, 2010c). This paper outlines the fungi and slime moulds recorded at Kings Park during these surveys.

METHODS

Fungi and slime moulds were surveyed at Kings Park from 9th June to 23rd July 2009 and from 15th June to 20th July 2010. Four sites representing different vegetation types in Kings Park were surveyed (Table 1). The surveys within the vegetation types were measured by a person x time basis – approximately 60 person time minutes per site

each survey time. The number and intensity of surveys were dictated by weather conditions and limitations imposed by the consultancy contract. All fungi and slime moulds observed were georeferenced, recorded and photographed *in situ*. Selected fungi were collected for later description, vouchering and identification. Fungi collected were photographed and representative specimens preserved as air-dried vouchers lodged at the Department of Environment and Conservation's Western Australian Herbarium, Kensington (PERTH). During recording and collecting, particular attention was given to many of the main microhabitats including open and mossy ground, litter, coarse woody debris such as logs, and bark of living trees. Specific vegetation or plant associations of the fungi and slime moulds were noted. Specimens were identified to species level when possible. Some other specimens were assigned species phrase names in accordance with the format and guidelines used by the Western Australian Herbarium (see guidelines in Florabase at <http://florabase.dec.wa.gov.au/>). Identification enabled assessment of probable broad ecological roles of the fungi and slime moulds, and determination of them as native or exotic.

RESULTS

Low rainfall was experienced in the Perth region in 2009 and 2010 and this would have limited the

Table 1. Sites surveyed for fungi at Kings Park in 2009 and 2010.

Site ID	Site Name	Details/ Coordinates	Vegetation	Notes	Survey Visits 2009	Survey Visits 2010
a	Magpie Path	Approx. 25 m on either side of 200 m length of path. Survey south point on paved path: 31° 57' 17.93" S x 115° 49' 54.83" E. North point on path: 31° 57' 11.71" S x 115° 49' 51.90" E.	Jarrah open woodland	This area was partly burnt in 2009. Some in vasive sugar gums are present.	3	2
b	Aberdare Lowland	Approx. 25 m on either side of 150 m length of path. Survey start point on sand track off May Drive: 31° 57' 57.50" S x 115° 49' 14.80" E. End point on track: 31° 58' 2.32" S x 115° 49' 12.97" E.	Mixed open forest – woodland	South side of track last burnt 1989. More timber than in site 3 on the north side of May Dr.	3	2
c	May Drive Sheoak	Approx. 25 m on either side of 250 m length of path. Survey start point on sand track off May Drive: 31° 58' 0.00" S x 115° 49' 22.02" E. End point on track: 31° 57' 57.13" S x 115° 49' 30.53" E.	<i>Allocasuarina/Banksia</i> low woodland.	Last burnt probably in 1962. Dominated by <i>Allocasuarina</i> and banksias but there is also a patch of young marri.	3	2
d	Forrest Drive Tuart (Block S18)	Area approx. 400 m in length x 100 m wide on interior side of Forrest Drive. Area approx. bounded by the following points: NE corner - 31° 57' 59.11" S x 115° 50' 8.51" NW corner - 31° 58' 6.88" S x 115° 49' 58.90" E. SE corner (at Forrest Dr.) - 31° 57' 58.90" S x 115° 50' 13.06" E. SW corner (at Forrest Dr.) - 31° 58' 7.44" S x 115° 49' 59.60" E.	Tuart woodland	Extensively burnt early in 2009. Fungi survey primarily in the remaining unburnt fringes.	4	2
e	Opportunistic	Entire area of Kings Park.	Natural and planted	Includes all other areas of bushland and gardens in the Park.	3	3

fruiting of fungi and slime moulds during the surveys. Never-the-less, at least 124 species of fungi and 14 species of slime moulds were recorded during the two surveys (Tables 2, 3). Ninety of the fungi and all of the slime moulds were identified to species level, and 34 of the fungi were assigned species phrase names. Only 21% of these fungi and slime moulds were recorded in both of the survey years (Tables 2, 3). Seventy six percent (94 out of 124) of the fungi and 86% (12 out of 14) of the slime moulds are considered to be new records for Kings Park. The new records include 59 fungi that were identified to species level, and 35 that were assigned phrase names.

During the surveys an additional 49 names (46 fungi and 3 slime moulds) referable to groups encompassing unknown numbers of unidentified species were also recorded (Appendix 1). Specimens assigned to these groups were not studied sufficiently during this work to confidently assign them a unique or formal identity, and they are not considered further in this paper.

Some other notable findings from the 2009–2010 surveys (Tables 2, 3):

- Saprotrophic fungi (100 species) were more diverse than mycorrhizal fungi (21) and pathogenic fungi (3, or 4 if *Omphalotus nidiformis* is considered sometimes to occur as a weak pathogen).
- Most of the fungi were found on dead wood such as logs and other coarse woody debris (68

fungi), and among leaf litter (43 fungi). All slime moulds were found on dead wood, although *Fuligo septica* had also spread extensively over leaf litter.

- Only three species of fungi and none of the slime moulds were recorded in all five of the survey sites: *Calocera guepinioides*, *Campanella gregaria*, and *Gymnopilus allantopus*.
- Five species of fungi and no slime moulds were observed on recently burnt ground: *Anthracobia melaloma*, *Hygrocybe* sp. Pearly, *Peziza tenacella*, *Pholiota highlandensis*, and *Pulvinula archeri*.
- One fungus species was observed in a high ammonia habitat– *Peziza moravecii* – attached to leaf litter adjacent to dog faeces in an advanced state of putrefaction.
- *Reddelomyces westraliense* was the only truffle species recorded.
- All species observed are considered to be indigenous to Kings Park except two fungal species: *Suillus granulatus* and *Puccinia myrsiphylli*.
- All of the slime mould species had been previously recorded in Western Australia. Species of fungi not recorded before in Western Australia include: *Arachnopeziza aurata*, *Dasyscyphus acuum*, *Galerina pumila*, *Peniophora scintillans*, *Pluteus perroseus*, *Propolis versicolor*, and *Trechispora microspora*.

Table 2. Records of fungi for Kings Park from field surveys in 2009 and 2010.

Phrase names are given in a format used by the Western Australian Herbarium (PERTH) to designate species that are either currently formally undescribed or have not been identified, i.e. the collector and collection number are given in brackets after the descriptor. If no collection it is labeled (s.n.).

Codes: A and B: Names based on Kings Park specimens vouchered or soon to be vouchered at the Western Australian Herbarium - A. Names identified to species level. B. Names identified only to genus or higher level. C and D: Names recorded from Kings Park without vouchers retained in the Western Australian Herbarium - C. Names identified to species level. D. Names identified only to genus or higher level. *Forms:* BR = bracket; CD = cup/disc; CO = coral; CU = cushion; CY = cyphelloid; FL = flask; JE = jelly fungus; MO = mould; MU = mushroom; PF = puffball/earthball; PS = pustules; RE = resupinate; RU = rust; SH = shell/fan/spoon; TR = truffle. *Ecology/Life modes (putative in most cases):* S = saprotrophic; P = pathogenic; M = mycorrhizal. *Microhabitat types:* A = Animal; B = Bark of living tree; BG = Burnt ground/litter; D = Dung; DT = Diseased or dying tree/plant; DW = Dead wood/logs; L = Leaf litter or soil; MB = Moss on bark of living tree; MG = Moss on ground, wood or rocks; U = Underground.

Fungi Name	Code	Form	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Aleurina ferruginea</i> (W. Phillips) W.Y. Zhuang & Korf	C	CD	S	L			a	Yes
<i>Aleurodiscus</i> sp. Pink-orange (N.L. Bougher E9357)	A	CD	S	DW	E9357	a		Yes
<i>Amanita cf. punctata</i> (Cleland & Cheel) D.A.Reid	C	MU	M	L			b	Yes
<i>Amanita fibrillosipes</i> O.K. Mill.	C	MU	M	L			b	Yes
<i>Amanita ochroterrea</i> Gentilli ex Bas	A	MU	M	L	PERTH7607512		d	No
<i>Amanita preissii</i> (Fr.) Sacc.	A	MU	S	L	Davison 3-2009 PERTH7547722, 7547714	a		No
<i>Amanita</i> sp. Ochre ring (N.L. Bougher & K. Roberts E9424)	B	MU	M	L	E9424	e		Yes
<i>Amanita walpolei</i> O.K. Mill.	A	MU	M	L	BOUGHER 650		a	Yes
<i>Amanita xanthocephala</i> (Berk.) D.A.Reid & R.N.Hilton	A	MU	M	L	PERTH 7607466, 920517	a		No
<i>Anthracobia melaloma</i> (Alb. & Schwein.: Fr.) Arnould	A	CD	S	BG	BOUGHER 560	a, d		Yes
<i>Arachnopeziza aurata</i> Fuckel	A	CD	S	DW	E9391	d		Yes

<i>Armillaria luteobubalina</i> Watling & Kile	A	MU	P	DT	PERTH768251	e	No
<i>Auriporia</i> sp. Orange-pored (N.L. Bougher E9325)	B	RE	S	DW	E9325, E9326	c	Yes
<i>Banksiamyces toomansii</i> (Berk. & Br.) G. Beaton	A	CD	S	DW	BOUGHER 665	b	Yes
<i>Bolbitius vitellinus</i> (Pers.: Fr.) Fr.	A	MU	S	L	PERTH7597304	e	No
<i>Boletus sinapecreuentus</i> Cleland	C	MU	M	L		c	Yes
<i>Calocera guepiniioides</i> Berk.	A	JE	S	DW	PERTH7608187	all	No
<i>Calocera</i> sp. Spindle (N.L. Bougher & K. Griffiths E9389)	B	JE	S	DW	E9389	d	Yes
<i>Campanella gregaria</i> Bougher	A	SH	S	DW	PERTH767892, E94164E9353, E9390,	all	No
<i>Ceriporia tarda</i> (Berk.) Ginns	A	RE	S	DW	BOUGHER 652	d	Yes
<i>Clavulima cristata</i> (Holmsk.) J. Schröt.	C	CO	M	L		a	Yes
<i>Clavulima vimaceoceruina</i> (Cleland) Corner	A	CO	M	L	E9455	a	Yes
<i>Clitocybe semioccultata</i> Cleland	A	MU	S	DW	PERTH755117	b	No
<i>Clitocybe</i> sp. Crowded gills, depressed cap (N.L. Bougher & J. Froudust E9447)	B	MU	S	L/DW	E9447	a, b	Yes
<i>Clitopilus hobsonii</i> (Berk.) P.D.Orton	A	SH	S	DW	BOUGHER 515, 525	a, c, d	Yes
<i>Coprinopsis cf. stangliana</i> (Enderle, Bender & Gröger) Redhead, Vilgalys & Moncalvo	A	MU	S	L	PERTH7240562, 7340570	d, e	No
<i>Cortinarius archeri</i> Berk.	A	MU	M	L	PERTH7658524, BOUGHER 615	c	No
<i>Cortinarius ochraceofulvus</i> Cleland	C	MU	M	L		a, d	Yes
<i>Crepidotus eucalyptorum</i> Cleland	A	SH	S	B	E9360	a, d	No
<i>Crepidotus mollis</i> (Schaeff.: Fr.) Staude	A	SH	S	DW	BOUGHER 648	b	No
<i>Crepidotus nephrodes</i> (Berk. & M.A.Curtis) Sacc.	C	SH	S	DW		b	Yes
<i>Crepidotus sphaerosporus</i> (Pat.) J.E.Lange	A	SH	S	DW	E9367	a	Yes
<i>Crinipellis</i> sp. Tiny cushions (N.L. Bougher & P. Broome BOUGHER 684)	B	MU	S	DW	BOUGHER 684	a	Yes
<i>Gudoniella</i> sp. Greenish (s.n.)	D	CD	S	L		e	Yes
<i>Dasyyscyphus actuum</i> (Alb. & Schwein.) Sacc.	A	CD	S	DW	E9421	e	Yes

Table 2 (cont.)

Fungi Name	Code	Form	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Dasycephalus</i> sp. Feather duster (N.L. Bougher & E.M. Davison BOUGHER 527)	B	CD	S	DW	BOUGHER 527	a		Yes
<i>Descolea maculata</i> Bougher	A	MU	M	L	BOUGHER 685		a	Yes
<i>Dichostereum pallescens</i> (Schwein.) Boidin & Lanq.	A	RE	S	DW	BOUGHER 649		d	Yes
<i>Exidia</i> sp. Blue (s.n.)	D	JE	S	DW		b		Yes
<i>Exidiopsis</i> sp. Yellow scabs (N.L. Bougher E9320)	B	JE	S	DW	E9320	c,d	b	Yes
<i>Fomitiporia robusta</i> (P.Karst.) Fiasson & Niemelä	C	BR	S	DT		b		Yes
<i>Fuscoporia cf. gilva</i> (Schwein.) T.Wagner & M.Fisch.	C	BR	S	DW			a	Yes
<i>Galerina nana</i> (Petri) Kühner	C	MU	S	L		e		Yes
<i>Galerina pumila</i> (Pers.: Fr.) Singer	A	MU	S	L	BOUGHER 672		e	Yes
<i>Galerina</i> sp. Orange-brown on wood (N.L. Bougher <i>et al.</i> E9417)	B	MU	S	DW	E9417	e		Yes
<i>Galerina</i> sp. Small brown in litter (N.L. Bougher & E.M. Davison E9359)	B	MU	S	L	E9359	a		Yes
<i>Galerina</i> sp. Small, decurrent gills (N.L. Bougher & P. Davison BOUGHER 637)	A	MU	S	L	BOUGHER 637		a	Yes
<i>Gymnopilus allantopus</i> (Berk.) Pegler	A	MU	S	DW	PERTH814571, E9355	all	a	No
<i>Gymnopilus cf. purpuratus</i> (Cooke & Masee) Singer	C	MU	S	DW		c,e		No
<i>Gymnopilus perplexus</i> B.J.Rees	A	MU	S	DW	BOUGHER 667		c	Yes
<i>Gymnopilus purpuratus</i> (Cooke & Masee) Singer	A	MU	S	DW	PERTH7608276	e	d	No
<i>Hemimyces</i> sp. Minute, fragile, white pileus, arcuate gills (N.L. Bougher & P. Robertson BOUGHER 526)	B	MU	S	L	BOUGHER 524, 526	a, c, d, e		Yes
<i>Henningsomyces candidus</i> (Pers. ex Schleich.: Fr.) Kuntze	A	CY	S	DW	E9361	a, d, e	b, c	Yes
<i>Hexagonia vesparia</i> (Berk.) Ryvarden	C	BR	S	B		d		Yes
<i>Hjortstamia crassa</i> (Lév.) Boidin & Gilles	A	RE	S	DW	BOUGHER 522	a, c, d		Yes

Table 2 (cont.)

Fungi Name	Code	Form	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Perenniporia ochroleuca</i> (Berk.) Ryvarden	C	BR	S	DW		b, e		Yes
<i>Peziza moravecii</i> (Svreekl) Donadini	A	CD	S	L	E9322	c		Yes
<i>Peziza tenacella</i> W. Phillips	A	CD	S	BG	BOUGHER 561	d		Yes
<i>Phaeotrametes decipiens</i> (Berk.) Lloyd ex J.E. Wright	C	BR	S	DT		b		Yes
<i>Phellinus</i> sp. Extensive resupinate (N.L. Bougher & P. Robertson E9454)	B	BR	S	DW	E9454	b, c	d	Yes
<i>Phlebia subceracea</i> (Wakef.) Nakasone	A	RE	S	DW	BOUGHER 666		c	Yes
<i>Phlotiota communis</i> (Cleland & Cheel) Grgur.	C	MU	S	DW			d	Yes
<i>Phlotiota highlandensis</i> (Peck) Quadr.	A	MU	S	BG	PERTH758817, BOUGHER 647,		d	No
<i>Phylloporus clelandii</i> Watling	A	MU	M	L	PERTH770973, 758667, BOUGHER 646	e	d	No
<i>Piptoporus australiensis</i> (Wakef.) G.Cunn.	C	BR	S	DT		d		No
<i>Pleuroflammula praestans</i> E. Horak	A	SH	S	DW	E9356	a		Yes
<i>Pluteus pauperculus</i> E. Horak	A	MU	S	DW	E9352 BOUGHER 686	a		Yes
<i>Pluteus perroseus</i> E. Horak	A	MU	S	DW	BOUGHER 635		a	Yes
<i>Pluteus petasatus</i> (Fr.) Gillet	A	MU	S	L/DW	BOUGHER 617		e	Yes
<i>Propolis versicolor</i> Fr.:Fr.	A	PS	S	DW	E9383	d		Yes
<i>Psathyrella</i> sp. Strong veil, burnt wood (N.L. Bougher & M. Brotherson BOUGHER 634)	B	MU	S	DW	BOUGHER 634		a	Yes
<i>Puccinia myrsiphilli</i> (Thüm.) G. Winter	C	RU	P	DT			a	Yes
<i>Pulvinula archeri</i> (Berk.) Rifai	A	CD	S	BG	BOUGHER 573	d		Yes
<i>Pycnoporus coccineus</i> (Fr.) Bondartsev & Singer	A	BR	S	DW	PERTH7572638	a, b, d, e	a, b	No
<i>Ramaria gracilis</i> (Pers.:Fr.) Quél.	C	CO	M	L			a, d	Yes

Table 3. Records of slime moulds for Kings Park from field surveys in 2009 and 2010. See key in caption for Table 2 for explanation of codes.

Slime Moulds Name	Code	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Arcyria cinerea</i> (Bull.) Pers.	C	S	DW		b		Yes
<i>Arcyria insignis</i> Kälchbr. & Cooke	C	S	DW			a	Yes
<i>Arcyria obvelata</i> (Oeder) Onsberg	C	S	DW			a	Yes
<i>Arcyria pomiformis</i> (Leers) Rostaf.	C	S	DW		a		Yes
<i>Ceratiomyxa fruticulosa</i> (O.F.Müll.) T.Macbr.	A	S	DW	E9420	b, d, e	a, b	No
<i>Collaria arcyriomena</i> (Rostaf.) Nann.-Bremek.	A	S	DW	PERTH6873006		a	No
<i>Fulligo septica</i> (L.) F.H.Wigg.	C	S	L		c		Yes
<i>Physarum viride</i> (Bull.) Pers.	C	S	DW		c	a	Yes
<i>Stemonitis lignicola</i> Nann.-Bremek.	C	S	DW			a	Yes
<i>Trichia decipiens</i> (Pers.) T.Macbr.	C	S	DW			d	Yes
<i>Trichia decipiens</i> var. <i>olivacea</i> (Meyl.) Meyl.	A	S	DW	E9477	a	b	Yes
<i>Trichia persimilis</i> P.Karst.	A	S	DW	E9300	a		Yes
<i>Trichia verrucosa</i> Berk.	A	S	DW	E9476	b		Yes
<i>Tubifera ferruginosa</i> (Batsch) J.F.Gmel.	A	S	DW			a	Yes



Figures 1–6. Examples of fungi and slime moulds recorded during the 2009–2010 surveys at Kings Park: 1. *Peziza tenacella* – a cup fungus which occurs on burnt ground after fire at Kings Park and elsewhere; 2. *Pluteus perroseus* – previously unrecorded in Western Australia, but also known in eastern Australia and New Zealand; 3. *Peniophora scintillans* – a resupinate fungus not recorded before in Western Australia; 4. *Lanzia* sp. Funnel, scurfy stem – occurs at Kings Park in large numbers on fallen wood of *Eucalyptus cladocalyx* (sugar gum); 5. *Peziza moravecii* – an ammonia fungus favouring high nitrogen microhabitats; 6. *Stemonitis lignicola* – one of the more conspicuous slime moulds at Kings Park.

DISCUSSION

All of the fungi apart from two, and all of the slime moulds recorded at Kings Park in 2009–2010 are considered to be indigenous. *Suillus granulatus* is a mycorrhizal associate of *Pinus*, and *Puccinia myrsiphylli* is a rust recently introduced to combat bridal creeper. However it is possible that at least some decomposer fungi such as *Volvariella speciosa* which inhabit disturbed areas and/or richly-mulched garden areas at Kings Park, and occur in such circumstances widely throughout the world, may have been introduced into the Perth region from elsewhere. This may also apply to some of the slime moulds. Only two of the 14 slime mould species identified during the surveys at Kings Park in 2009–2010 had been recorded there before 2009 – *Ceratiomyxa fruticulosa* and *Collaria arcyronema* (Jordan *et al.* 2006). However all the species had been previously recorded in Western Australia (Knight and Brims 2010), and many slime mould species are cosmopolitan.

Fungi were recorded in a wide range of microhabitat types at Kings Park, but the majority of them (55%) were found growing on wood, emphasizing the significance for fungal diversity of retaining logs and other coarse woody debris in the bushland at Kings Park. Slime moulds were found predominantly on logs and coarse woody debris, except for *Fuligo septica* which proliferates in heavily mulched areas often with woodchips. Five fungal species

were observed on recently burnt ground indicating that the post-fire recovery of fungi at Kings Park is similar to the successional pattern that occurs in eucalypt bushlands elsewhere in temperate Australia (McMullan-Fisher *et al.* 2011). This is particularly signified by the occurrence in Kings Park of the widespread post-fire species *Anthracobia melaloma*, *Peziza tenacella*, *Pholiota highlandensis*, and *Pulvinula archeri*. However some other widespread fire-responsive fungal species may be rare or absent at Kings Park. In particular it is notable that some of the more conspicuous species of post-fire fungi in eucalypt ecosystems have not been recorded at Kings Park, e.g. *Laccocephalum tumulosum* (Cooke and Masec) Nunez and Ryvardeen, a widespread large fungus which has been observed after fire in some nearby urban bushlands in Perth (Griffiths and Bougher 2008).

The presence of *Peziza moravecii* is indicative that another type of post-disturbance fungal succession is operating at Kings Park. *P. moravecii* is an ammonia fungus – it is representative of a chemoecological group of fungi with exclusive or enhanced mycelial and fruiting activity in the presence of ammonia nitrogen. Successional assemblages of ammonia fungi can occur naturally in organic nitrogen-rich circumstances such as near animal corpses, urine and dung depositions, or other ammonia-rich post putrefaction sites. Eight other species of ammonia fungi have been recognized in Western Australia after treatment of soil with urea (e.g.

see Fukiharu *et al.* 2011). More species of ammonia fungi in addition to *P. moravecii* may be expected to occur at Kings Park.

Reddelomyces westraliense was the only truffle species recorded at Kings Park in 2009–2010. Only two other native truffle species have been recorded at Kings Park to date – *Hydnangium carneum* Wallr. and *Thaxterogaster* sp. (Bougher 2010a). The paucity of truffle records may be due to the low sampling effort for truffles so far at Kings Park. However the diversity of truffle species in many of Perth’s urban bushlands may be substantially reduced compared with more contiguous bushland areas outside the urban area where many hundreds of truffle species may occur (Bougher and Lebel 2001). Reduction in truffle diversity may reflect the reduction or loss of native mammal vectors of truffles such as woylies and bandicoots in many of Perth’s urban bushlands. About 30 species of native truffles have been found in urban bushlands of Perth, including 11 species at Bold Park less than 10 km distant from Kings Park (Bougher, unpublished data).

To date, the number of fungi and slime moulds identified to species level at Kings Park is 168 and 26 respectively. The total for fungi is comprised of: (a) 108 named species of fungi recorded before 2009 (Bougher 2010a); (b) 59 records in 2009–2010 that were identified to species level and not recorded from Kings Park before 2009; and (c) addition of *Lysurus mokusin* (L.) Fr., which was found

and identified for the first time at Kings Park in 2009 (voucher BOUGHER 588) outside the period of survey in late December. The total for slime moulds includes 12 species identified at Kings Park for the first time in 2009–2010 plus 14 other species named prior to 2009.

The total number of fungi and slime mould species known from Kings Park to date is undoubtedly much greater than the above figures, but the number cannot be accurately determined. This is because many of the pre–2009 and 2009–2010 records remain unidentified or are possibly inaccurately identified. For example, in 2009–2010 many fungi and slime moulds were observed that could not be identified or assigned species phrase names during the surveys. Furthermore, each of the identified or phrase-named records from 2009–2010 was designated as “previously recorded” or “new” simply because the same name had or had not been recorded before 2009. In most cases the designations need to be verified by comparing specimens from 2009–2010 with those from before 2009. The species identity of some of the pre–2009 names have not yet been verified, i.e. 140 pre–2009 names with vouchers, and many of the others can never be verified, i.e. 145 pre–2009 names without vouchers (Bougher 2010a).

It is however certain that many more species occur at Kings Park than those recorded from there so far. This is indicated by the large proportion of putatively new records for Kings Park from

the 2009–2010 surveys (76% of the fungi, and 86% of the slime moulds). It is also indicated by the many as yet unidentified fungi species encompassed among the 49 taxonomically unresolved groups from the 2009–2010 surveys, and among the mostly unresolvable 285 names of fungi recorded at Kings Park before 2009 (Bougher 2010a). In order to adequately document the diversity of fungi and slime moulds at Kings Park it will be necessary to undertake numerous further surveys. Many new and different species are likely to be recorded during each year of survey, such as in 2009 and 2010 when only 21% of the fungal and slime mould species were recorded in both years at Kings Park. Such differences reflect the unpredictable and intermittent fruiting patterns of fungi, and the temporal, spatial and personnel constraints placed on survey effort. These factors influence and usually restrict the number and types of fungi observed in any particular survey. Annual surveys may be desirable at Kings Park for at least ten years. At nearby Bold Park a substantial proportion of the fungi records each year over an eleven year period since 1999 have been new for that park. Currently the estimated total number of putative fungal species recorded at Bold Park is 461 (Bougher 2010b). It is likely that a similar richness of fungi to that of Bold Park will be revealed at Kings Park if numerous further surveys are undertaken there. In tandem with further surveys, an increased taxonomic

effort will be desirable to curb the accumulation of records, particularly of unidentified fungi.

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APPENDIX 1

Additional fungi and slime moulds from field surveys in 2009 and 2010 at Kings Park.

“Genus ragbags” represent undetermined numbers of unidentified species belonging to the same genus. Ragbag groups are designated as new if the genus had not been recorded at Kings Park before 2009. “Undetermined” names represent unidentified putative species belonging to an undetermined genus. They may be new records for Kings Park but require further study to confirm that status. See key in caption for Table 2 for explanation of the codes used in this table.

Name	Code	Form	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Amanita</i> Ragbag, white no ring	D	MU	M	L			a	No
<i>Amanita</i> Ragbag, white with ring	B	MU	M	L	Davison 30-2010		a, d	No
<i>Arcyria</i> Ragbag	D	Slime Mould	S	DW		b		Yes
<i>Beauveria</i> Ragbag	D	MO	P	A		a		Yes
<i>Bovista</i> Ragbag	D	PF	S	L			a	Yes
Bracket fungus Ragbag	D	BR	S	B		e		No
<i>Clitocybe</i> Ragbag, no odour	B	MU	S	DW	BOUGHER 670	e	a, c	No
<i>Crepidotus</i> Ragbag	B	SH	S	DW	PERTH7612699	d, e		No
<i>Cyphelloid</i> Ragbag	D	CY	S	DW		d		Yes
<i>Dasyscyphus</i> Ragbag	D	CD	S	DW		d		Yes
<i>Exidia</i> Ragbag	D	JE	S	DW		d, e	a, b	No
<i>Ganoderma</i> Ragbag	D	BR	S	DW		d		Yes
<i>Gymnopilus</i> Ragbag	D	MU	S	L		c		No
<i>Gymnopus</i> Ragbag	B	MU	S	L	E9450	a, c		No
<i>Hohenbuehelia</i> Ragbag	D	SH	S	DW		d		No
<i>Lepiota</i> Ragbag	A	MU	S	L	E9450	b		No
<i>Mycena</i> Ragbag, in litter	D	MU	S	L		e	a	No

<i>Mycena</i> Ragbag, on wood	D	MU	S	DW			c, e	a, d	No
<i>Phellinus</i> Ragbag bracket-like	D	BR	S	DW				a	Yes
<i>Phlebia</i> Ragbag	B	RE	S	DW		BOUGHER 511	a, b, c, d		Yes
<i>Pisolithus</i> Ragbag	D	PF	M	L			d	a, d	No
<i>Pleurotellus</i> Ragbag	D	SH	S	DW			c, d, e		Yes
<i>Pluteus</i> Ragbag, delicate on wood	D	MU	S	DW				d	No
<i>Poria</i> s.l. Ragbag	D	RE	S	DW			b, c, d, e		No
<i>Psathyrella</i> Ragbag, in litter	B	MU	S	L		E9415	e	a	No
<i>Psathyrella</i> Ragbag, on wood	D	MU	S	DW				d	No
<i>Resupinate</i> Ragbag	D	RE	S	DW			e	a	No
<i>Slime mould</i> Ragbag	D	Slime Mould	S	DW//L			c, d	d	No
<i>Stemonitis</i> Ragbag	D	Slime Mould	S	DW				a	Yes
<i>Undetermined agaric</i> Dark chestnut hairy base (N.L. Bougher E9354)	B	MU	S	L		E9354	a		?
<i>Undetermined ascomycete</i> Minute dull brown cushions (N.L. Bougher & P. Davison E9364)	B	CD	S	DW		E9364	a		?
<i>Undetermined ascomycete</i> Minute dull tan discs on wood (s.n.)	D	CD	S	DW				a	?
<i>Undetermined ascomycete</i> Minute grey discs on wood (s.n.)	D	CD	S	DW			a	?	?
<i>Undetermined ascomycete</i> Minute orange discs (N.L. Bougher & K. Rae E9365) (lichen?)	B	CD	S	DW		E9365	a, d, e		?
<i>Undetermined ascomycete</i> Minute yellow discs on wood (s.n.)	D	CD	S	DW			c		?
<i>Undetermined hydroid</i> Resupinate-bracket (s.n.)	D	RE/BR	S	DW			d		?
<i>Undetermined</i> Minute white shell (s.n.)	D	SH	S	DW				c	?

Appendix 1 (cont.)

Name	Code	Form	Life Mode	Micro Habitat	Collector's Voucher Code and/or PERTH No.	Sites in 2009	Sites in 2010	New Record
<i>Undetermined</i> Mould ochraceous (s.n.)	D	MO	S	DW		a	a	?
<i>Undetermined resupinate</i> Bright yellow, pored (s.n.)	D	RE	S	DW		a	a	?
<i>Undetermined resupinate</i> Entirely white, smooth (s.n.)	D	RE	S	DW			b	?
<i>Undetermined resupinate</i> Grey smooth (s.n.)	D	RE	S	DW		a	a	?
<i>Undetermined resupinate</i> Grey, rhizomorphic (s.n.)	D	RE	S	DW		d	d	?
<i>Undetermined resupinate</i> Mustard curtains (s.n.)	D	RE	S	DW			d	?
<i>Undetermined resupinate</i> Pale grey velvety (s.n.)	D	RE	S	DW		a	a	?
<i>Undetermined resupinate</i> Waxy, white & ochre-orange, tubes (NL. Bougher BOUGHER 638)	B	RE	S	DW	BOUGHER 638		a	?
<i>Undetermined resupinate</i> White & ochre, smooth (s.n.)	D	RE	S	DW		d	d	?
<i>Undetermined resupinate</i> White and brown, pored (s.n.)	D	RE	S	DW		d	d	?
<i>Undetermined resupinate</i> White lacerate curtains (s.n.)	D	RE	S	DW		c	c	?
<i>Undetermined resupinate</i> White smooth sterile (s.n.)	D	RE	S	DW		b	b	?